

vinylcyclohexane, etc.; halogen-substituted  $\alpha$ -olefins such as hexafluoropropene, tetrafluoroethylene, 2-fluoropropene, fluoroethylene, 1,1-difluoroethylene, 3-fluoropropene, trifluoroethylene, 3,4-dichloro-1-butene, etc.; and cyclic olefins such as cyclopentene, cyclohexene, norbornene, 5-methylnorbornene, 5-ethylnorbornene, 5-propylnorbornene, 5,6-dimethylnorbornene, 5-benzylnorbornene, etc.

Styrenes for the method are not specifically defined, but preferred are styrene, alkylstyrenes, and divinylbenzene. Especially preferred are styrene,  $\alpha$ -methylstyrene, p-methylstyrene and divinylbenzene.

They include styrene; alkylstyrenes such as p-methylstyrene, p-ethylstyrene, p-propylstyrene, p-isopropylstyrene, p-buthylstyrene, p-tert-buthylstyrene, p-phenylstyrene, o-methylstyrene, o-ethylstyrene, o-propylstyrene, o-isopropylstyrene, m-methylstyrene, m-ethylstyrene, m-isopropylstyrene, m-buthylstyrene, mesitylstyrene, 2,4-dimethylstyrene, 2,5-dimethylstyrene, 3,5-dimethylstyrene etc.; alkoxystyrene such as p-methoxystyrene, o-methoxystyrene, m-methoxystyrene etc.; halogen-substituted styrene such as p-chlorostyrene, m-chlorostyrene, o-chlorostyrene, p-bromostyrene, m-bromostyrene, o-bromostyrene, p-fluorostyrene, m-fluorostyrene, o-fluorostyrene, o-methyl-p-fluorostyrene etc.; trimethylsilylstyrene, vinylbenzoate esters,

divinylbenzene etc.

In the invention, one or more olefins or styrenes such as those mentioned above may be copolymerized in any desired combination.

## 2. Copolymerization condition:

The method for polymerizing olefins and styrenes is not specifically defined and may be any ordinary one including, for example, slurry copolymerization, solution copolymerization, vapor-phase copolymerization, bulk copolymerization, suspension copolymerization, etc. In the method, the order of contacting the catalyst components with monomers is not also specifically defined. One embodiment comprises contacting the catalyst components with each other to prepare a catalyst in advance in the manner mentioned above, followed by applying monomers to the catalyst batch. Another comprises putting the catalyst components and monomers into a copolymerization reactor in any desired order. Preferably, the components except the component (C) or except the components (C1) and (C2), or that is, the components (A), (B) and (D) are blended in a reactor, while, on the other hand, monomers are blended with the component (C) or with the components (C1) and (C2) in a different reactor, and the two blends in different reactors are mixed just before the start of copolymerization of the monomers. Having been thus blended, the monomers begin to polymerize in the presence of the catalyst

formed in situ.

For the copolymerization, a solvent may be used. The solvent includes hydrocarbons and halogenohydrocarbons such as benzene, toluene, xylene, n-hexane, n-heptane, cyclohexane, methylene chloride, chloroform, 1,2-dichloroethane, chlorobenzene, etc. One or more of these compounds may be used either singly or as combined for the solvent. Depending on their type, the monomers to be polymerized could serve as a copolymerization solvent.

The amount of the catalyst to be used for the copolymerization is preferably so controlled that the component (A) may fall generally between 0.1 and 100  $\mu\text{mols}$ , but preferably between 0.5 and 25  $\mu\text{mols}$ , in one liter of the solvent, in view of the copolymerization activity and the reactor efficiency.

Regarding the copolymerization condition, the pressure may fall generally between normal pressure and 2000  $\text{kg/cm}^2\text{G}$  (196 MPaG). The reaction temperature may fall generally between  $-50$  and  $250^\circ\text{C}$ . For controlling the molecular weight of the polymer to be produced, the type and the amount of the catalyst components to be used and the copolymerization temperature shall be suitably controlled, or hydrogen may be introduced into the copolymerization system.

### 3.Olefin-sterene copolymer

The olefin-sterene copolymer by the copolymerization of